CLAIMS

What is claimed is:

1. A method of calibrating a field of view of a sensor within an observable area, comprising the steps of:

defining a reference image of a first observable area having at least one distinctive feature, said reference image defined by a first sensor placed at a base location;

establishing a set of reference points relative to said first sensor that represent a location within said reference image of said at least one distinctive feature;

placing a second sensor in a second observable area that is similar to said first observable area, said second sensor being placed in a location that generally corresponds in position to said base location;

obtaining a test image of said second observable area, said test image obtained by said second sensor and depicting at least one distinctive feature present in said second observable area; and

comparing said set of reference points to said at least one distinctive feature depicted in said test image in order to assess a relative accuracy in placement of said second sensor.

2. The method according to claim 1, wherein said first observable area and said second observable area are duplicate environments.

3. The method according to claim 1, wherein said at least one distinctive feature in said first observable area and said at least one distinctive feature in said second observable area represent identical physical features.

4. The method according to claim 1, wherein said comparing step comprises the further steps of:

transforming said test image into a distance image by assigning a location value to every pixel making up said test image, said location value representing a distance between said pixel and said distinctive feature depicted in said test image that lies closest to said pixel;

mapping said set of reference points onto said distance image for at least one possible orientation of said second sensor, said at least one orientation residing in a defined region of space; and

calculating an average distance between said at least one distinctive feature depicted in said test image and said set of mapped reference points, said calculated average distance representing a relative level of accuracy between a presumed orientation of said second sensor and an actual orientation of said second sensor.

5. A method of calibrating a field of view of a sensor within an observable area, comprising the steps of:

obtaining a test image of the observable area, said test image comprising a plurality of pixels;

transforming said test image into a distance image by assigning a location value to each pixel within said test image, said location value representing a distance between said pixel and a distinctive feature that lies closest to said pixel;

mapping at least one set of reference points, representing an ideal location of said at least one distinctive feature, onto said distance image for at least one possible orientation of said sensor, said at least one orientation residing in a defined region of space;

calculating an average distance between said at least one distinctive feature in said distance image and said at least one set of mapped reference points, said calculated average distance representing a relative level of accuracy between said presumed orientation of said sensor and an actual orientation of said sensor.

6. The method according to claim 5, wherein said orientation includes an angular position of said sensor, said angular position representing said orientation of said sensor along three angular axes of rotation.

7. The method according to claim 5, wherein said at least one distinctive feature comprises at least one contrasting edge in the interior of a vehicle.

8. The method according to claim 7, wherein said at least one contrasting edge is part of a window frame, vehicle door or vehicle dashboard.

9. The method according to claim 5, wherein said defined region of space represents a tolerance associated with sensor placement.

10. The method according to claim 9, wherein said sensor placement tolerance accounts for both discrepancies induced in said orientation of said sensor during said sensor's installation, and discrepancies subsequently induced in said orientation of said sensor during operation of a vehicle.

11. The method according to claim 5, wherein said at least one set of reference points is mapped to said distance image for a predetermined number of orientations within said defined region of space.

12. The method according to claim 5, further comprising the steps of:

selecting at least one of said at least one possible orientations of said sensor that yields a corresponding calculated average distance, between said at least one distinctive feature in said distance image and said at least one set of mapped reference points, below a predetermined threshold;

defining a sub-region of space around each of said selected orientations;

mapping said at least one set of reference points onto said distance image for at least one possible sub-regional orientation of said sensor, said at least one sub-regional orientation residing in one of said defined sub-regions of space;

calculating an average distance between said at least one distinctive feature in said distance image and said at least one set of mapped reference points for each of said at least one possible sub-regional orientations of said sensor; and

presuming said sub-regional orientation that yields the lowest calculated average distance to represent an approximation of said actual orientation of said sensor.

13. The method according to claim 12, wherein said steps of claim 8 are reiterated one or more times, wherein each time a new region of space, smaller in size than previous regions defined in a prior iteration of said steps, is defined around one or more selected orientations.

14. A vehicle occupancy sensing (VOS) system, comprising:

a digital sensor mounted within a vehicle in such a manner as to be able to generate an image of an interior of the vehicle;

a processor in communication with said sensor and capable of analyzing said image generated by said sensor in accordance with at least one heuristic; and

memory in communication with said processor and capable of storing data generated by said processor,

wherein said at least one heuristic includes a calibration heuristic that instructs said sensor to generate an image of the vehicle interior and said processor to identify and isolate within said image at least one distinctive feature of the vehicle interior, whereupon said processor compares an image location of said at least one distinctive feature to at least one set of reference points for a plurality of different presumed sensor positions,

said comparison yielding the closest set of reference points for said presumed sensor position that best estimates an actual position of said sensor.

15. The vehicle occupancy sensing system of claim 14, wherein said at least one distinctive feature of the vehicle interior comprises a contrasting edge.

16. The vehicle occupancy sensing system of claim 14, wherein said calibration heuristic is automatically carried out on a periodic basis.

17. The vehicle occupancy sensing system of claim 14, wherein said calibration heuristic is carried out when the vehicle has no occupants.

18. The vehicle occupancy sensing system of claim 14, wherein said calibration heuristic is carried out right before the vehicle is powered down.

19. The vehicle occupancy sensing system of claim 14, wherein said sensor position includes at least a translational position of said sensor.

20. The vehicle occupancy sensing system of claim 14, wherein said sensor position includes at least a rotational orientation of said sensor.

21. The vehicle occupancy sensing system of claim 14, wherein said calibration heuristic is repeated at least once with an increased level of accuracy compared to a previous run of said calibration heuristic.

22. A method of calibrating a field of view of a sensor for a vehicle occupancy sensing system, comprising the steps of:

generating a digital image of an interior of the vehicle;

identifying within said image at least one distinctive feature of the vehicle interior, said at least one distinctive feature appearing in the image as an edge existing between two regions of differing contrast;

comparing within said image a location of said at least one identified distinctive feature to at least one set of reference points, said at least one set of reference points adjusted for one particular position of the sensor and representing an ideal location of said at least one distinctive feature for said particular sensor position;

repeating said comparison step a plurality of times, each time adjusting said at least one set of reference points for a different particular position of the sensor; and

determining which particular position of the sensor yields at least one set of adjusted reference points that most closely match said location of said at least one identified distinctive feature, said determined particular position estimating an actual position of the sensor.

23. The method according to claim 22, wherein said position of the sensor represents a three-dimensional translational location of the sensor.

24. The method according to claim 22, wherein said position of the sensor represents a three-dimensional rotational orientation of the sensor.

25. The method according to claim 22, wherein said at least one distinctive feature is part of a window frame, vehicle door or vehicle dash.

26. The method according to claim 22, wherein all of said different particular positions of the sensor, to which said at least one set of reference points are adjusted to, lie within a predefined region of space.

27. The method according to claim 26, wherein said predefined region of space is based upon specified mounting tolerances in said position of the sensor.

28. The method according to claim 22, further comprising the steps of:

comparing within said image said location of said at least one identified distinctive feature to said at least one set of reference points, said at least one set of reference points re-adjusted for one particular sub-position of the sensor, said sub-position based upon said previously estimated actual position of the sensor;

repeating said comparison step a plurality of times, each time adjusting said at least one set of reference points for a different particular sub-position of the sensor; and

determining which particular sub-position of the sensor yields at least one set of adjusted reference points that most closely match said location of said at least one

identified distinctive feature, said determined particular sub-position representing a more accurate estimate of said actual position of the sensor.